Industrial productivity through ABB
Cover Story

The front cover shows how by working together, Jura Cement and ABB Switzerland Ltd achieved the first known successful application of a MLD system on a cement mill. ABB's wide and successful experience with this technology made it keen to see what benefits it could bring to other parts of the cement process and therefore approached Jura Cement about a collaboration to apply this cutting edge technology to one of their grinding units. The outcome for Jura Cement's Wildegg plant has been that the mill can be run for maximum production, achieving their Blaine targets, and also ensuring energy inputs and additives are used efficiently and effectively. Jura Cement has the first plant in the world the experience the benefits of ABB applying MLD to a cement mill.

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Jura Cement’s MLD advantage

by Michelle Kiener & Dr Eduardo Gallestey
ABB Switzerland, Switzerland

Jura Cement is profitable and efficient. But it knows that to stay that way, and indeed improve, it must stay at the forefront of all new industry developments. Therefore when the Automation & IT Solutions division of ABB Switzerland Ltd approached its Wildegg plant in Switzerland about testing a new application of MLD technology, it saw a natural fit between two active, dynamic and progressive companies.

A world first
Working together, Jura Cement and ABB have achieved the first successful application of a MLD system on a cement mill. ABB has a great deal of experience with this new technology. For instance, it has successfully applied MLD together with Model Predictive Control (MPC) within its Raw Mix Preparation (RMP) solution, where the solution is already online and controlling processes at many different cement plants. Additionally, its Alternative Fuels Management Module is also based on MLD and MPC technology.

The successful application of this technology made ABB keen to see what benefits it could bring to other parts of the cement process. Knowing that Jura Cement is always prepared to be involved in prudent new developments for the industry, ABB approached Jura Cement about a collaboration project to apply this cutting edge technology to one of its grinding units.

The MLD advantage
MLD systems were recently developed at the Automatic Control Laboratory at the Swiss Federal Institute of Technology, ETH Zürich, with whom ABB launched a strategic collaboration at the beginning of this decade. MLD systems generalise a wide set of models, among which there are processes where continuous parts interact with discrete ones, known as ‘Hybrid Systems’. A good example of a Hybrid System is a power transformer, where the voltage, a physical quantity, is modelled as a continuous variable and the state of the equipment (the transformer tap) is in fact a discrete variable that regulates the range of the voltage output. Unlike common linear models, MLD systems are able to model common constraints, like logic relations of the type: ‘For Unit 1 to be ON then Unit 2 must be OFF’, or production constraints like: ‘either NO production, or production between MIN and MAX’. In addition, this technique also allows consideration of piece-wise linear time varying dynamics.

The advantage of MLD modelling, when combined with an MPC system, as was the case at Wildegg, is that the solution can make good predictions about the process evolution in the near future. It can evaluate the merits of control decisions and it selects and implements the best series of control decisions into the future. This is done by the model giving a prediction of the quality after the mill. Further, the MLD mill model is not a black box like in ‘standard MPC tools’.

For the first time, a Mixed Logical Dynamic (MLD) system has been applied to a cement mill. MLD systems have been applied elsewhere in the cement industry, to control kilns and raw mix for example, but not on a cement mill. ABB Switzerland Ltd (ABB) and Jura Cement explain why they teamed up to try this ground breaking new application.
but, constructed in the Expert Optimizer
graphical model building toolkit, it is a
clear representation of the real system
relationships with components that
have clear interpretation for versed
process engineers. This increases the
understanding and makes maintenance
easier. The mathematical complexity
is hidden, and only relevant process
knowledge is presented.

Using information from the online
sensors and laboratory data, the model
compares the prediction to the cost
and quality targets and optimises
accordingly. A series of current and
future optimal changes to the mill set-
points are selected and then the decision
is implemented. Lastly the effects of
process unpredictability and dynamics
are absorbed and fed into the model to
further improve predictions and decisions.
The benefits of being able to make
process decisions by looking forward
instead of backward are:
• an optimal and tight tracking of quality
targets at the highest production rates
• the early smoothing of long and
medium-term disturbances
• process dynamics are competently
handled.

Another striking fact was the short
commissioning time of this system.
Indeed, in a matter of a few days the
system was up and running. This is a
consequence of the online adaptive
features introduced in the system, which
make the most out of the partner’s deep
process knowledge.

Partners in experience
At Wildegg, this has meant that the mill
can be run for maximum production,
while achieving Blaine targets, and also
ensuring energy inputs and additives are
used efficiently and effectively. For ABB it
has meant a successful project outcome
from the first application of MLD on a
cement mill.

Dr Eduardo Gallestey, ABB Switzerland
Ltd, product manager for Optimizer
Systems, said “It’s really nice for me to
see the MLD for cement mills applied on
a real plant in such a short time scale.
I’m very happy with the outcome. And
Wildegg has been the perfect partner
for us in this because its work processes
are very well designed and managed so
Wildegg have been able to give us really
good feedback on our work there”.

What’s next for MLD and
cement mills?
Dr Gallestey replies “next we will carefully
review the results, including looking at
developing other models for other plants
that have different optimisation objectives
and different mill configurations. After this
phase we will be making available a very
robust solution to the market place to be
run and enjoyed by our customers with
minimal input from ABB.

“I especially look forward to seeing
the benefits that our unique application
of MLD will bring to other cement mills.’
These are benefits that Jura Cement,
thanks to its foresight, is the first cement
plant in the world to experience.